Claims

What is claimed is:

1. A method for fabricating nanostructures, comprising:
   (a) contacting a stamp having a plurality of raised regions and a plurality of recessed regions with a film, thus forming a plurality of contacts between the stamp and the film, where the film resides on a supporting substrate;
   (b) compressing the stamp into the film to form a plurality of deformations in the film;
   (c) flowing at least one chemical reagent through at least one of an upper channel formed between the stamp and the film and a lower channel formed between the film and the supporting substrate to chemically modify at least a portion of the film; and
   (d) separating the stamp from the film, where the nanostructures are formed from the film.

2. The method of claim 1, where steps a through d are repeated.

3. The method of claim 1, where the compressing applied to the stamp includes the use of one or more curved compression plates.

4. The method of claim 1, where the smallest feature dimension of the stamp is from 1 to 5000 nm.

5. The method of claim 1, where the stamp includes at least one of a polymer, a co-polymer, and a polymer composite.

6. The method of claim 1, where the stamp includes at least one of poly(methyl methacrylate), polybutadiene, polystyrene, and polycarbonate.

7. The method of claim 1, where the stamp is made from a material having a Young's Mo dulus of at least 10^7 Pa.

8. The method of claim 1, where the stamp is made from a material having a Young's Mo dulus from 10^8 to 10^{10} Pa.

9. The method of claim 1, where the stamp includes at least one of sloped sidewall and rectangular sidewall geometry.

10. The method of claim 1, further comprising exposing the stamp to radiation.

11. The method of claim 1, where the film includes metal.

12. The method of claim 1, where the film includes gold.

13. The method of claim 1, further comprising depositing the film on the supporting substrate.

14. The method of claim 1, where the supporting substrate includes at least one of a solid, a porous solid, muscovite mica, silicon, and glass.

15. The method of claim 1, where the compressing of the stamp into the film to form a plurality of deformations in the film further comprises

cutting through at least a portion of the film.

16. The method of claim 1, where the plurality of deformation in the film include at least one of an elastic deformation and a plastic deformation.

17. The method of claim 1, where the stamp undergoes at least one of an elastic deformation and a plastic deformation.

18. The method of claim 1, where the chemical modifying includes a partial removal of the film.

19. The method of claim 1, where the at least one chemical reagent includes a metal etchant.

20. The method of claim 1, where after separating the stamp from the film, at least a portion of the nanostructures reside on the supporting substrate.

21. The method of claim 1, where after separating the stamp from the film, at least a portion of the nanostructures reside on the stamp.

22. The method of claim 1, where the nanostructure is a wire.

23. The method of claim 1, further comprising incorporating the nanostructures into a device.

24. The method of claim 1, where the nanostructures reside on at least one of the raised regions and the recessed regions of the stamp.

25. The method of claim 24, where the nanostructures reside on both the raised regions and the recessed regions of the stamp.

26. The method of claim 24, further comprising transferring at least a portion of the nanostructures to a support.

27. The method of claim 26, where the transferring includes a plurality of transfers to form at least one of a multi-dimensional architecture, a three-dimensional architecture, a binary array architecture, and a multilayered three-dimensional architecture.

28. The method of claim 1, where the nanostructures have an average cross-section from 1 nm to 1 μm.

29. The method of claim 1, where the nanostructures have an average cross-section from 1 nm to 500 nm.

30. The method of claim 1, where the nanostructures have an average cross-section from 50 nm to 1 μm.

31. The method of claim 1, where the nanostructures have an average cross-section of less than 120 nm.

32. A device including the nanostructures formed by the method of claim 1, where the device is at least one of a stamp, a photonic device, a band-gap device, and an X-Ray stencil, where the X-Ray

stencil is suitable for use in a photolithography process.

33. A method of patterning a surface, comprising:

(a) contacting a stamp having a plurality of raised regions and a plurality of recessed regions with a film residing on a supporting substrate to form a plurality of contacts between the stamp and the film;

(b) compressing the stamp into the film to form a plurality of deformations in the film;

(c) flowing at least one chemical reagent through at least one of an upper channel formed between the stamp and the film and a lower channel formed between the film and the supporting substrate to chemically modify at least a portion of the film; and

(d) separating the stamp from the supporting substrate, where at least a portion of the nanostructures formed from the film remain embedded in the stamp; then

(e) transferring the stamp including the embedded nanostructures on a photoresist;

(f) introducing radiation to the stamp, where only a portion of the radiation contacting the stamp passes through the stamp and reaches the photoresist.